

# CONSOLIDATED INFORMATION TECHNOLOGY SERVICES TASK ASSIGNMENT (TA)

1. **TITLE:** (E302) Conversion of CERES Science Data Processing Codes to OpenSource

<b>TA No:</b>	REB001-Rev9	
<b>Task Area Monitor:</b>	<b>Alternate Task Area Monitor:</b>	
<b>NASA POC:</b>	<b>Software Control Class:</b>	Low Control
<b>Type of Task:</b>	Non-Recurring Task	

## 2. BACKGROUND

Code development and testing takes place in the CERES Science Computing Facility, located in Building 1250 with data product production and distribution to the public occurring in Building 1268. Codes are largely built in FORTRAN 95 with some using ADA, IDL with control scripts built in PERL and UNIX shell scripting language. Currently, product production is performed in an SGI3800 environment. Initial processing occurs subsequent to all data inputs being received with subsystems being exercised in a specific order to generate the successively higher order data products. Re-processing of the data as algorithms are improved is expected to occur several more times over the life of the data; in order to capture the scientific value of a new algorithm, the entire collection of observed data must be re-processed within a year from initiation of a production run; this requires processing 10-15 data months of data per processing month, which is known as 10x processing. Costs associated with the SGI computational environment are quite high and constrain this reprocessing of data with improved algorithms; it is expected that running in an open source environment will permit more and faster re-processing with the same high quality results. A new computational environment has been defined which consists of Macintosh G5 cluster and IBM 970 cluster computing. A next generation cluster consisting of Mac Intel-based platforms is undergoing initial planning and code conversion.

The CERES Mission Manager requests continuing mission software support for CERES instruments being flown on Earth Observation Systems (EOS) missions. This support will include maintenance and modifications of instrument flight software, mission operations, and modification/updates to related data bases. It is anticipated that continued support will be needed in future contract performance periods for the next several years.

TRW, Redondo Beach, California, manufactured 6 CERES instruments for space-based earth observations on different EOS satellites. Currently, there are four CERES Instruments operating in orbit. Flight models FM-1 and FM-2 are on the Terra spacecraft, and flight models FM-3 and FM-4 are on the Aqua spacecraft. An additional two instruments are undergoing proposal and evaluation: FM-5 on NPP and FM-6 on NPOESS.

For CERES instruments, FM-1 through FM-6, the support will be primarily related to orbital operations, and will involve modifications to instrument flight software required to facilitate special operations that the science team will request at various times. Support will also involve possible instrument flight software modifications needed to facilitate diagnosis of and correction for any operational anomalies that might be encountered.

For CERES instruments, FM-5 and FM-6, the support will be related to preparation for launch and checkout.

#### Background for Calipso Effort

NASA Langley Research Center is developing the Calipso Mission in cooperation with the French Centre National d'Etudes Spatiales (CNES) for the purpose of studying aerosols and clouds in the Earth atmosphere. The Calipso Payload primary instrument is a two-wavelength LIDAR being developed by NASA-LaRC via contract to Ball Aerospace and Technologies Corporation (BATC). Completing the Payload instrumentation are an Imaging Infrared Radiometer (IIR) provided by CNES via contract with Sodern in Paris, France and a Wide Field Camera provided by BATC. BATC is currently building, qualifying, and functionally testing the Payload with delivery planned for February 2004.

CNES is providing their standard Proteus Platform via contract with Alcatel Space in Cannes, France. The Payload will be shipped to Alcatel to begin Satellite level assembly and testing not later than March 2004. The integrated Proteus Platform and Calipso Payload (Satellite) will complete comprehensive testing in late December 2004. The satellite launch date is planned for March 2005 aboard a Delta II launch vehicle.

The Calipso Project is requesting support for development of procedures required for operation of the Payload during the testing with the Proteus Platform. To facilitate this support, Contractor personnel will be required to become thoroughly familiar and operationally proficient with the Payload flight software and the Payload operations. Contractor personnel will modify BATC integration procedures to conform to the test environment at the Alcatel Space platform facility.

### 3. OBJECTIVE

This task has three objectives:

- (1) convert code designed to run on an SGI environment into code which can be executed on an open source environment, including intel-based systems;
- (2) Mission operations support for CERES;
- (3) planning, analysis and test support for FM-5 and FM-6 instruments

The Contractor will be required to provide CERES Mission-level planning and software support including maintenance and modification of instrument flight software, mission operations software, procedures, and related databases.

The contractor shall also, working with the CERES Instrument Manager, develop initial concepts for simulator design for the FM-5 instrument integrated into NPP. Further implementation shall be at the discretion of the CERES Instrument Manager and the Task Monitor.

- **GENERAL IT SUPPORT SERVICES**

**Services Specified Through Exhibit A:**

CERES Performance Standard: Deliver S/W patches as required by the CERES Mission Manager. Validate microprocessor flight loads using ground simulators.

**Performance Metrics:**

Exceeds: Delivers software items ahead of need date. Provides supporting data to validate functionality of patches or mods. Formulates a flight system test that will demonstrate an anomaly resolution in the affected flight model.

Meets: Deliveries are on time for need date. Simulations have been done to validate S/W, but supporting data files may not be available.

Fails: Deliveries are late, and simulations have not been completed.

**General IT Support Services Performance Metrics**

Performance Standard: Required documentation is complete, understandable, and up-to-date.

Performance Metrics:

Exceeds: Documentation is error free, complete, and up-to-date. Significant improvements have been made in the clarity of documentation.

Meets: Documentation is complete with only minor errors noted.

Fails: One or more required documentation components are not available or errors are noted that could compromise the operation or integrity of the systems.

Performance Standard: Documentation covering the use of application software covered by this requirement is complete, understandable, and up-to-date.

Performance Metrics:

Exceeds: Documentation is error free, complete and up-to-date. Significant improvements have been made in the clarity of documentation or documentation is proactively sought from all sources.

Meets: Documentation is complete with only minor errors noted

Fails: One or more required documentation components are not available or errors are noted that could compromise the operation or integrity of the applications.

○ **SYSTEM AND APPLICATION DEVELOPMENT SERVICES**

Project Title: Convert CERES Clouds Code

LaRC Software Manager: m.m.little

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: NASA Langley personnel will provide current code and as-is documentation, input data for two sets of 2-month test data and 2 sets of output benchmarks for comparison. Contractor personnel will plan for, convert code

and test it and perform demonstration of functionality and performance.

**Requirements:**

Task A) Planning. Working within the context of their knowledge of the CERES Science Data Processing architecture and the related production model, the contractor shall maintain its understanding of the relationship among the various codes and scripts, the software engineering approach in use in CERES, and the delivery process used by CERES to place code into production at the Langley DAAC. Utilizing the results of this task and inputs from the Government, the contractor shall provide a process diagram and a schedule (Gant chart) for performing the other tasks of this work authorization.

Task B) Continue to update the list of previously identified improvements to codes which would permit it to run efficiently on a LINUX cluster at the ASDC and in a grid context. Update the documented lessons learned and issues to be addressed in subsequent efforts in tuning the code to run in a cluster environment, as well as lessons learned to be applied in other code conversions. Develop a strategy for transferring the knowledge and insight gained in this code conversion process to other CERES development personnel.

Document the results of Tasks A, B in a formal report.

**Constraints:**

Subject to the availability of time after mission FM5 support allows

**Acceptance Criteria:**

Performance Standard:

Convert and demonstrate the CERES TISA subsystem to run at 10x on an intel-based LINUX cluster, producing the identical data products content as that produced on the SGI3800, or acceptable technical explanations as to the nature of the variances.

Exceeds: 12 months after start of Contract Year, all Code Conversion is complete.

Meets: The subsystem is converted completely and runs on the ASDC intel-based LINUX cluster producing data products at greater than 2x with a strategy for achieving at least 10x rates to produce data products.

Fails: Any of the requirements of this subsection (a through c) are not satisfied.

Project Title: Support CERES Mission Manager

LaRC Software Manager: Mike Cisewski

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: Deliver S/W patches and/or operations workaround as required by the CERES Mission Manager. Validate patches or modifications using ground simulator. Develop conceptual approaches to implementing a simulator for CERES FM5 on NPP. Develop and maintain FM5 I&T procedures. Develop and maintain FM5 command and telemetry database. Upgrade and maintain FM1-FM4 flight software maintenance utilities for FM5.

**Requirements:**

See Responsibilities

**Constraints:**

None

**Acceptance Criteria:**

Exceeds: Delivers items ahead of need date. Provides supporting data to validate functionality of patches or mods. Formulates a flight system test that will demonstrate an anomaly resolution in the affected flight model.

Meets: Deliveries are on time for need date. Simulations have been done to validate S/W, but supporting data files may not be available.

Fails: Deliveries are late, and simulations have not been completed.

**Deliverables:**

Number	Deliverable Item	Deliverable Schedule
1	Concepts for CERES FM5 simulators	Deliver consistent with program planning (which is evolving at this time) for NPP mission.
2	FM5 Ground test procedures for I&T	Deliver according to NPP I&T milestone schedule
3	FM5 Command and Telemetry database	Deliver according to NPP I&T milestone schedule

Project Title: Project Management

LaRC Software Manager: Michael Little

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:The contractor shall provide project management support, primarily in the area of schedule development, monitoring, and analysis.

**Requirements:**

The contractor shall provide analysis of NASA plans and schedules, resource allocations to develop high quality schedules and project management documentation.

**Constraints:**

The contractor shall utilize formats consistent with Science Directorate planning processes.

**Acceptance Criteria:**

Documents provided shall be of an appropriate level of detail and format as agreed by the NASA manager.

○ **WORK-AREA SPECIFIC SERVICES**

None required.

- **Exhibit A**

None required.

- **SPECIAL SECURITY REQUIREMENTS**

The Contractor personnel performing this support will need badging and appropriate security status to facilitate access to operations and test facilities at LaRC, VAFB, and Ball Aerospace. The CERES Project Office will normally submit requests for Contractor badging along with requests for Civil Service and other support personnel.

- **SOFTWARE ENGINEERING PROCESS REQUIREMENTS**

Software engineering practices and procedures should be similar to those of existing CERES code, EOS-DIS and NPOESS.

Since the Payload flight software and Platform flight software are being developed by other partner organizations, these systems are already under process control, and no additional controls are required. The Contractor may choose to incorporate whatever normal Raytheon process controls they choose in order to assure compliance with version control or configuration management processes already in place at LaRC, and Ball.

- **JOINT REVIEW SCHEDULE**

A Monthly Status Report shall be submitted electronically to the Task Manager and Alt Task Manager, and will serve as the vehicle for joint review. At least one informal review will be held each quarter between the Task Manager and the Contractor's Lead Engineer. In addition, informal verbal reports of the status of software developments and/or reviews, procedure development, or test operations may be requested at the normal CERES project meetings

- **PERIOD OF PERFORMANCE**

This TA is effective from 02/01/04 to 04/27/10

- **TECHNICAL PERFORMANCE RATING**

For Mission Operations and related Ground Support Operations, both quality of product and timeliness of submission are typically equally important. Therefore, the Technical Performance Rating shall be rated as follows:

Quality: 50%      Timeliness: 50%  
Code Conversion and Simulator concepts

Quality: 90%      Timeliness: 10%  
Plan is complete and feasible.

Quality: 50%    Timeliness: 50%

- **RESPONSE REQUIREMENTS**

Within two weeks of the receipt of this task assignment, submit to the Contracting Officer's Representative, an original and two copies of a Task Plan. this Task Plan shall address the contractor's lead personnel, specific work plans, and the associated estimated labor hours, cost and schedule. Include a signature block for concurrence by the Contract Manager and approval by the Contracting Officer's Representative.

- **GOVERNMENT ESTIMATED COST**

- **FUNDING INFORMATION**

Funding has not been entered for this TA.

- **MILESTONES**

Date	MileStones
03/31/2010	Complete CERES Code Conversion Tasking
03/31/2010	Complete mission ops requirements
03/31/2010	Complete Project Planning and Scheduling task assignments
03/31/2010	Complete FM-5 and FM-6 work.

- **DELIVERABLES**

Number	Deliverable Item	Deliverable Schedule
1	Monthly Status Report for CERES Activity	First week of each month of TA Deliver 1 copy to TAM and 1 copy to CERES Mission Manager
2	CERES Flight Software Support Items	<p>The deliverables for this requirement shall be written reports describing the flight software anomaly or behavior and whether the behavior is considered normal or erroneous. Written reports shall be conveyed by electronic mail either in text format or as an MS Word attachment. If a flight software patch and/or workaround scenario is required, then the contractor shall provide the Mission Manager with the patch file(s) in the format defined by the ground system(s) to which the effected instrument(s) belong(s). If a procedure is required, the procedure shall be provided to the Mission Manager, and the procedure(s) shall be written in the ground system language specified by the ground system(s) to which the effected instrument(s) belong(s).</p> <p>Schedule of Deliverables Flight software anomalies are unpredictable but their resolution tends to be of high priority. Changes in scan profiles or</p>

		operational scenarios are typically moderate priority comensurate with the value of the data to be collected. The contractor shall provide the Mission Manager with an assessment of schedule impact for each flight software maintenance event. With Mission Manager concurrence the contractor shall proceed to implement the highest priority deliverable as soon as possible. If no flight software anomalies occur or operations changes are required for a given flight model, there are no deliverables for that reporting period.
3	CERES End-of-Task Items	At the end of the task the Contractor shall deliver on disk media the following items: a) Updated versions of instrument flight software archives. b) Currently archived versions of BCU software. c) Electronic versions of any flight software patches developed along with appropriate descriptive documentation. d) Any command or telemetry database modifications along with appropriate descriptive documentation. e) Any new or updated instrument I and T or Flight Oerations procedures along with appropriate descriptive documentation. f) Utility development software used in development of instrument software patches, along with appropriate documentation. g) Final summary report of the effort under this TA
4	Procedures for use in Payload Testing	Deliverables for this Work Area will be the modified procedures for Satellite level testing. The actual number of procedures is still to be determined, but is expected to be in excess of 10 different procedures. The Contractor will also be required to maintain reference copies of all procedures developed, and any standard command loads.  Schedule of Deliveries: Need dates will be determined by the overall Platform Integration schedule, and will be coordinated with the TAM and the Mission AIT Manager.
5	FM5 Simulator Concepts	Consistent with NPP program plan as it evolves.
6	Clouds Code Conversion	Contractor shall deliver to TAM or his designated hitter all converted codes and scripts and any documents of Plans, procedures, or "how-to" manuals developed over teh course of the conversion effort.

○ **FILE ATTACHMENTS**

None.